National Institute of Environmental Health Sciences

Shifts in comparative advantages for maize, oat and wheat cropping under climate change in Europe

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Year: 2012

Journal: Food Additives & Contaminants. Part A, Chemistry, Analysis, Control, Exposure & Risk Assessment. 29 (10): 1514-1526

Abstract:

Climate change is anticipated to affect European agriculture, including the risk of emerging or re-emerging feed and food hazards. Indirectly, climate change may influence such hazards (e.g. the occurrence of mycotoxins) due to geographic shifts in the distribution of major cereal cropping systems and the consequences this may have for crop rotations. This paper analyses the impact of climate on cropping shares of maize, oat and wheat on a 50-km square grid across Europe (45-65 degrees N) and provides model-based estimates of the changes in cropping shares in response to changes in temperature and precipitation as projected for the time period around 2040 by two regional climate models (RCM) with a moderate and a strong climate change signal, respectively. The projected cropping shares are based on the output from the two RCMs and on algorithms derived for the relation between meteorological data and observed cropping shares of maize, oat and wheat. The observed cropping shares show a south-to-north gradient, where maize had its maximum at 45-55 degrees N, oat had its maximum at 55-65 degrees N, and wheat was more evenly distributed along the latitudes in Europe. Under the projected climate changes, there was a general increase in maize cropping shares, whereas for oat no areas showed distinct increases. For wheat, the projected changes indicated a tendency towards higher cropping shares in the northern parts and lower cropping shares in the southern parts of the study area. The present modelling approach represents a simplification of factors determining the distribution of cereal crops, and also some uncertainties in the data basis were apparent. A promising way of future model improvement could be through a systematic analysis and inclusion of other variables, such as key soil properties and socio-economic conditions, influencing the comparative advantages of specific crops.

Source: http://dx.doi.org/10.1080/19440049.2012.700953

Resource Description

Climate Scenario :

specification of climate scenario (set of assumptions about future states related to climate)

Special Report on Emissions Scenarios (SRES), Other Climate Scenario

Special Report on Emissions Scenarios (SRES) Scenario: SRES A1

Other Climate Scenario: Regional Climate Models (RCM); A1B; KNMI; HC

Exposure : ☒

weather or climate related pathway by which climate change affects health

Extreme Weather Event, Food/Water Quality, Food/Water Security, Precipitation, Temperature

Extreme Weather Event: Drought

Food/Water Quality: Biotoxin/Algal Bloom

Food/Water Security: Agricultural Productivity

Temperature: Extreme Heat

Geographic Feature: ☒

resource focuses on specific type of geography

Rural

Geographic Location: ☒

resource focuses on specific location

Non-United States

Non-United States: Europe

Health Impact: ☒

specification of health effect or disease related to climate change exposure

Health Outcome Unspecified

Model/Methodology: ☒

type of model used or methodology development is a focus of resource

Exposure Change Prediction, Other Projection Model/Methodology

Other Projection Model/Methodology: climate models for impact studies on food hazards

Resource Type: ☒

format or standard characteristic of resource

Research Article

Timescale: ☒

time period studied

Medium-Term (10-50 years)

Vulnerability/Impact Assessment: ☒

resource focus on process of identifying, quantifying, and prioritizing vulnerabilities in a system

A focus of content